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Dentin Phosphoprotein Mimetic Peptide Nanofibers Promote Biomineralization

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Abstract

© 2018 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim. Dentin phosphoprotein (DPP) is a major component of the dentin matrix playing crucial role in hydroxyapatite deposition during bone mineralization, making it a prime candidate for the design of novel materials for bone and tooth regeneration. The bioactivity of DPP-derived proteins is controlled by the phosphorylation and dephosphorylation of the serine residues. Here an enzyme-responsive peptide nanofiber system inducing biomineralization is demonstrated. It closely emulates the structural and functional properties of DPP and facilitates apatite-like mineral deposition. The DPP-mimetic peptide molecules self-assemble through dephosphorylation by alkaline phosphatase (ALP), an enzyme participating in tooth and bone matrix mineralization. Nanofiber network formation is also induced through addition of calcium ions. The gelation process following nanofiber formation produces a mineralized extracellular matrix like material, where scaffold properties and phosphate groups promote mineralization. It is demonstrated that the DPP-mimetic peptide nanofiber networks can be used for apatite-like mineral deposition for bone regeneration.

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Keywords

Biomineralization, Dentin phosphoprotein, Osteogenic differentiation, Peptide amphiphile